

*Update on lifetime measurement
and
wire analysis*

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Reason

- Re-analyzed data (respect to the plot shown at the ORR) adding a cut to reject non-crossing tracks (potential decaying muons from Michel trigger)
- Following last Friday's meeting, I realized the cut I had on the track angle was wrong, as I was assuming the wrong reference frame
- Re-analyzed data again adding few (hopefully correct – I need your input on this) cuts
- With a first estimation of the lifetime, I can calculate the lifetime-corrected dQ/dx per wire, to check whether the PMTs are affecting the charge collection at the wires. If we can observe and quantify such an effect, we can correct for it (and measure again the lifetime)

New Cuts

Beside rejecting non-crossing tracks (crossing any two faces), hits of induction plane, first and last hit of the track, hits that are not the only ones on the wire, potential deltas aligned to the track, I apply this cuts in this order:

➤ **$20^\circ < \text{Zenith Angle} < 80^\circ \parallel 100^\circ < \text{Zenith Angle} < 160^\circ$**

Remove straight vertical or straight horizontal tracks

➤ **$20^\circ < \text{Respect-to-Z Angle} < 80^\circ \parallel 100^\circ < \text{Respect-to-Z Angle} < 160^\circ$**

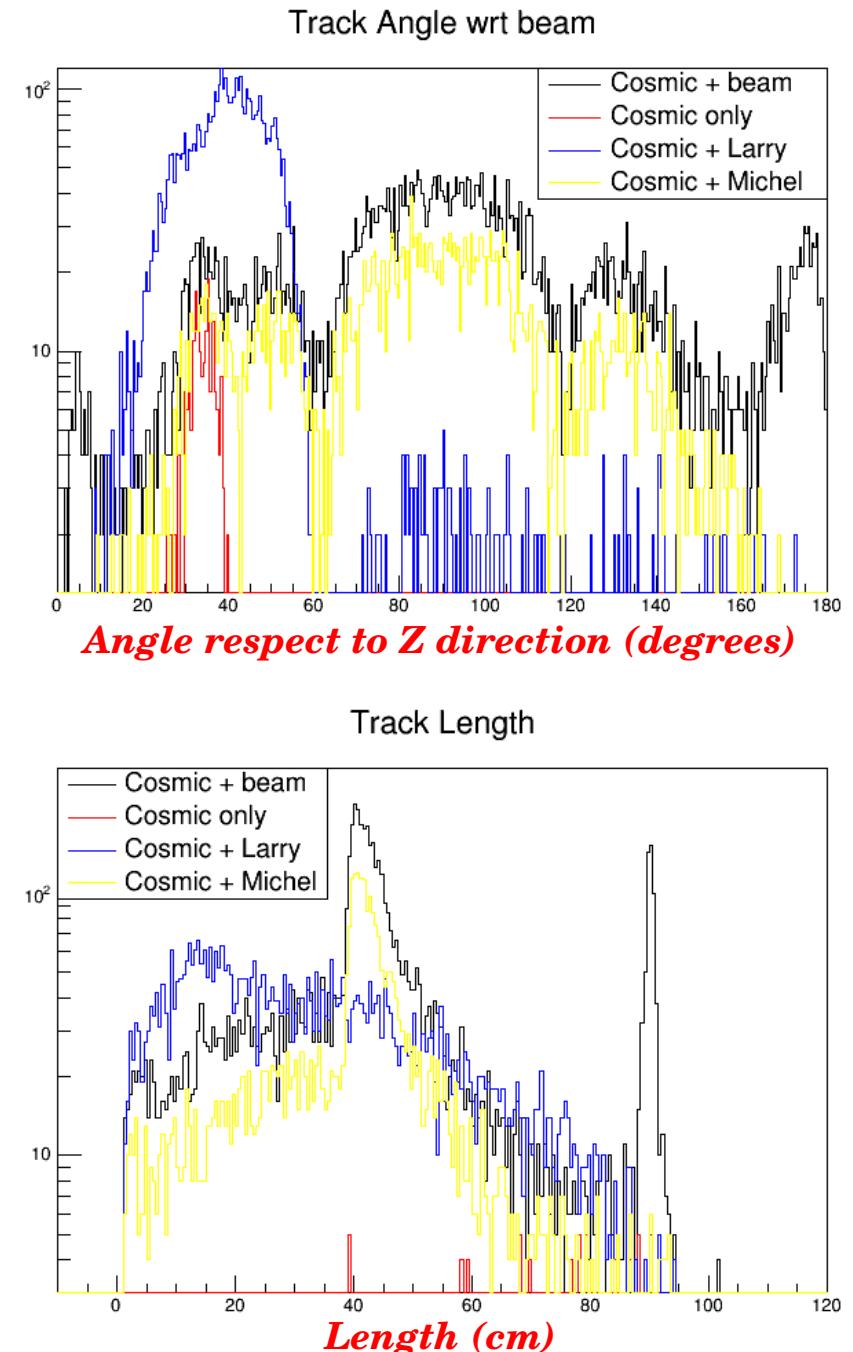
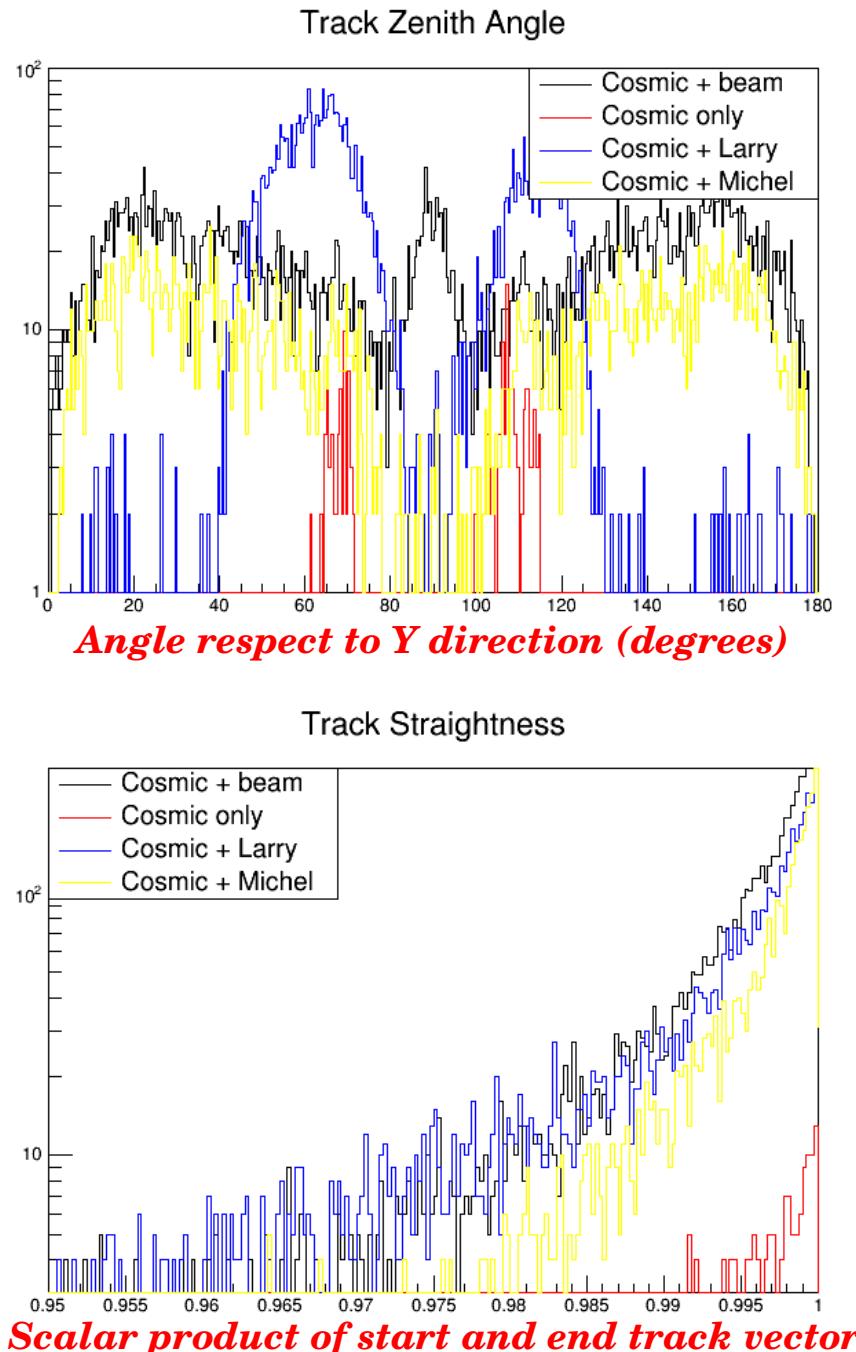
Remove tracks aligned or perpendicular to the beam

➤ **Straightness > 0.99**

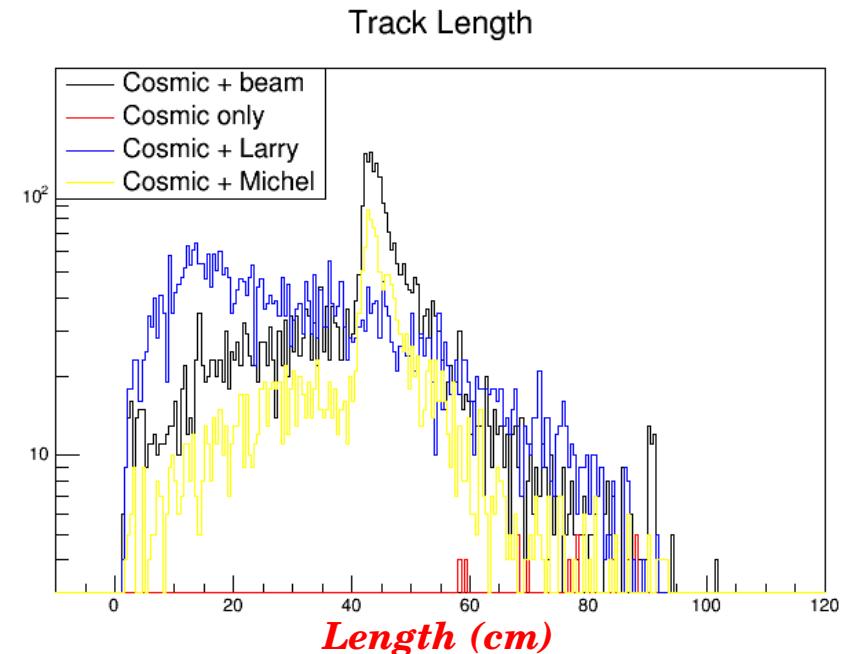
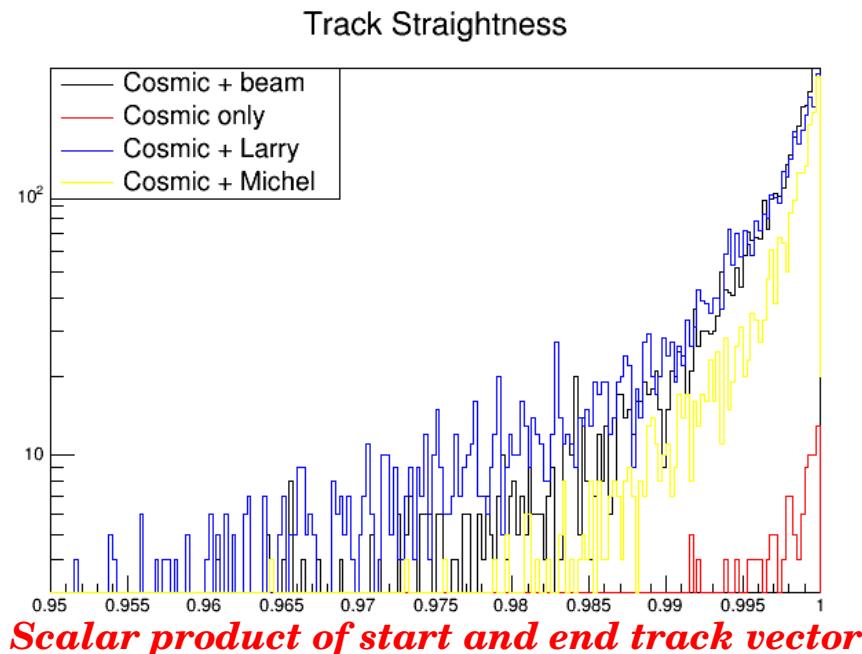
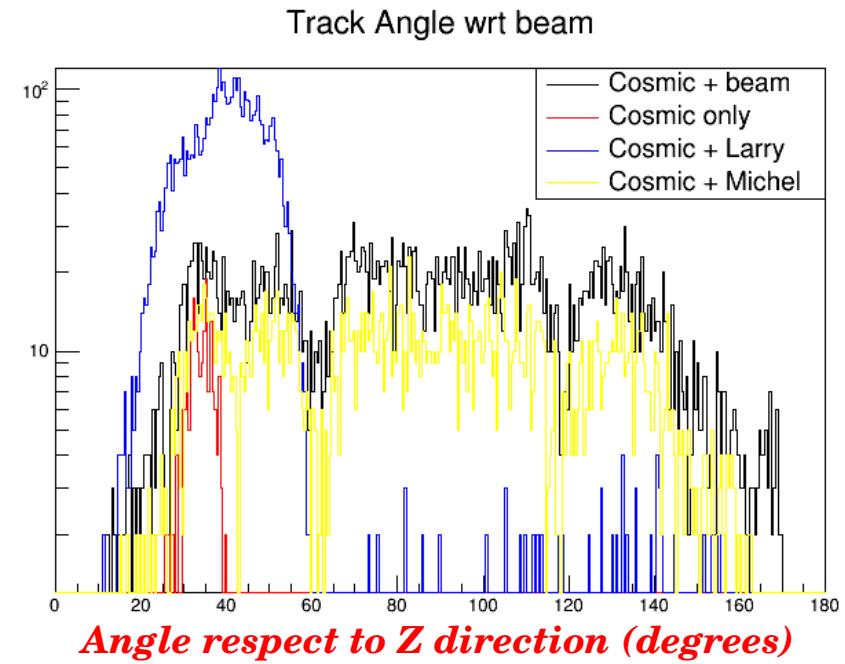
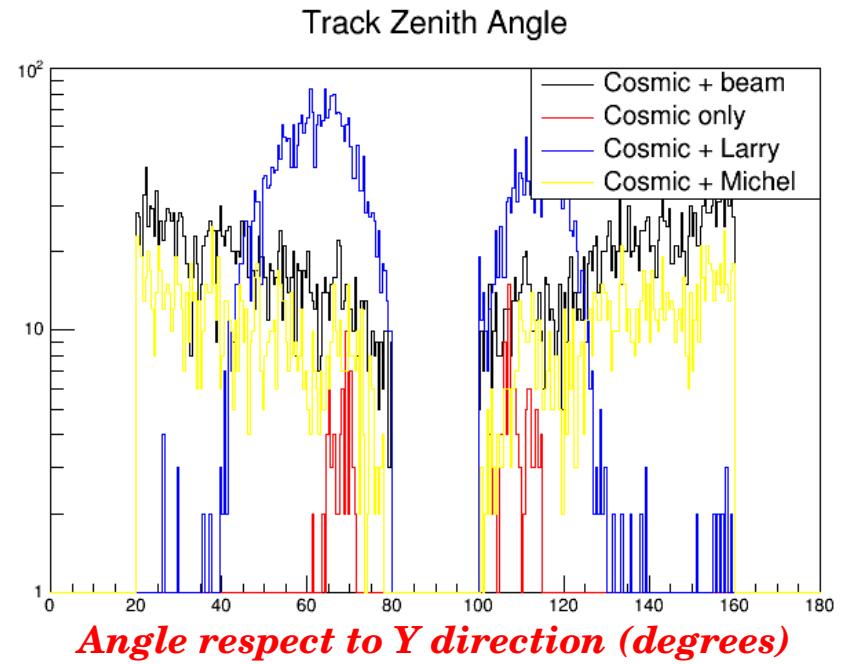
Scalar product between beginning and end of track directions

➤ **Track Length > 10 cm**

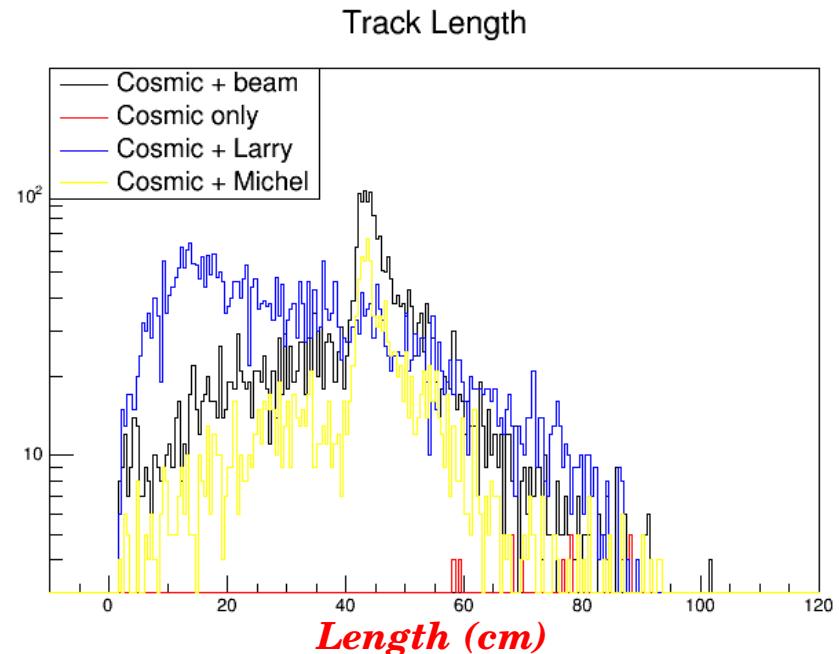
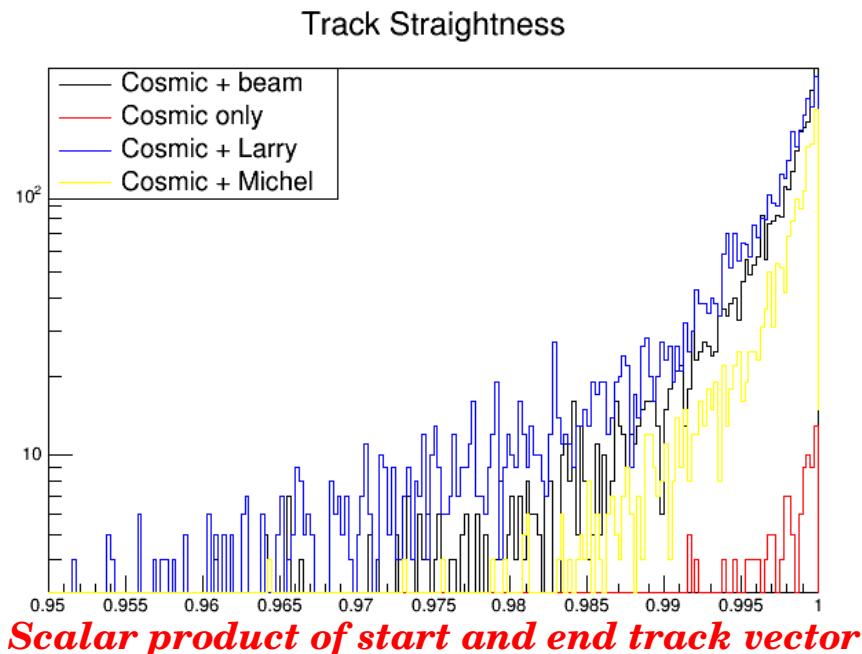
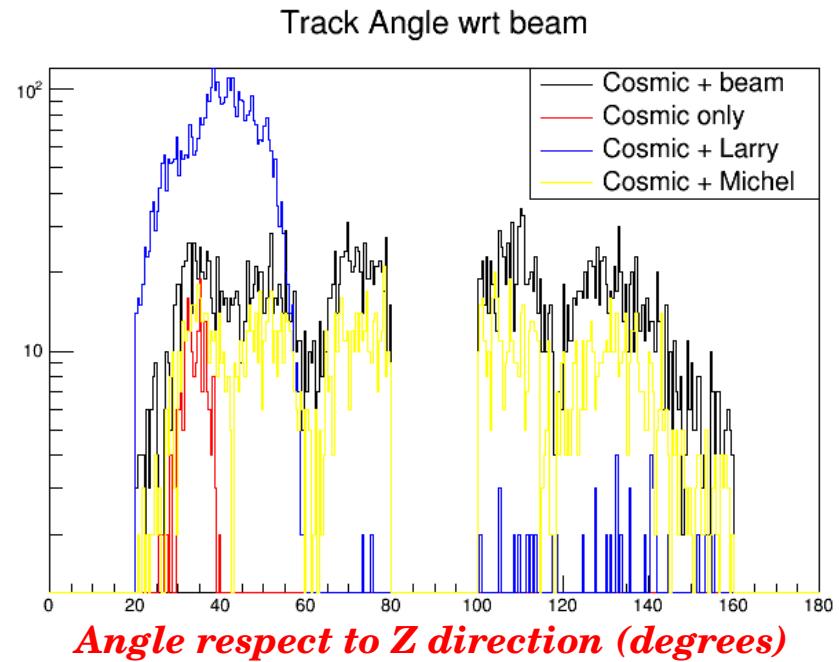
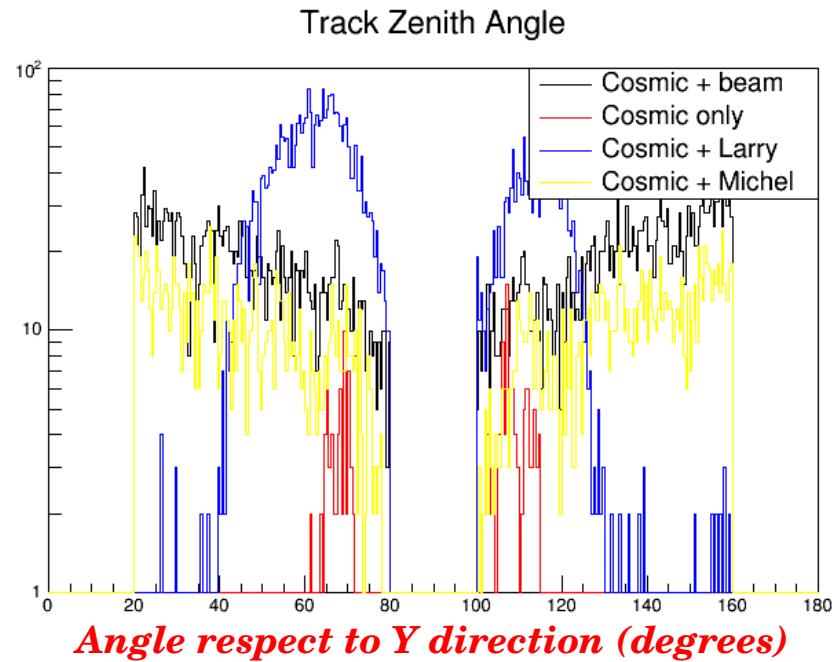
Before the cuts



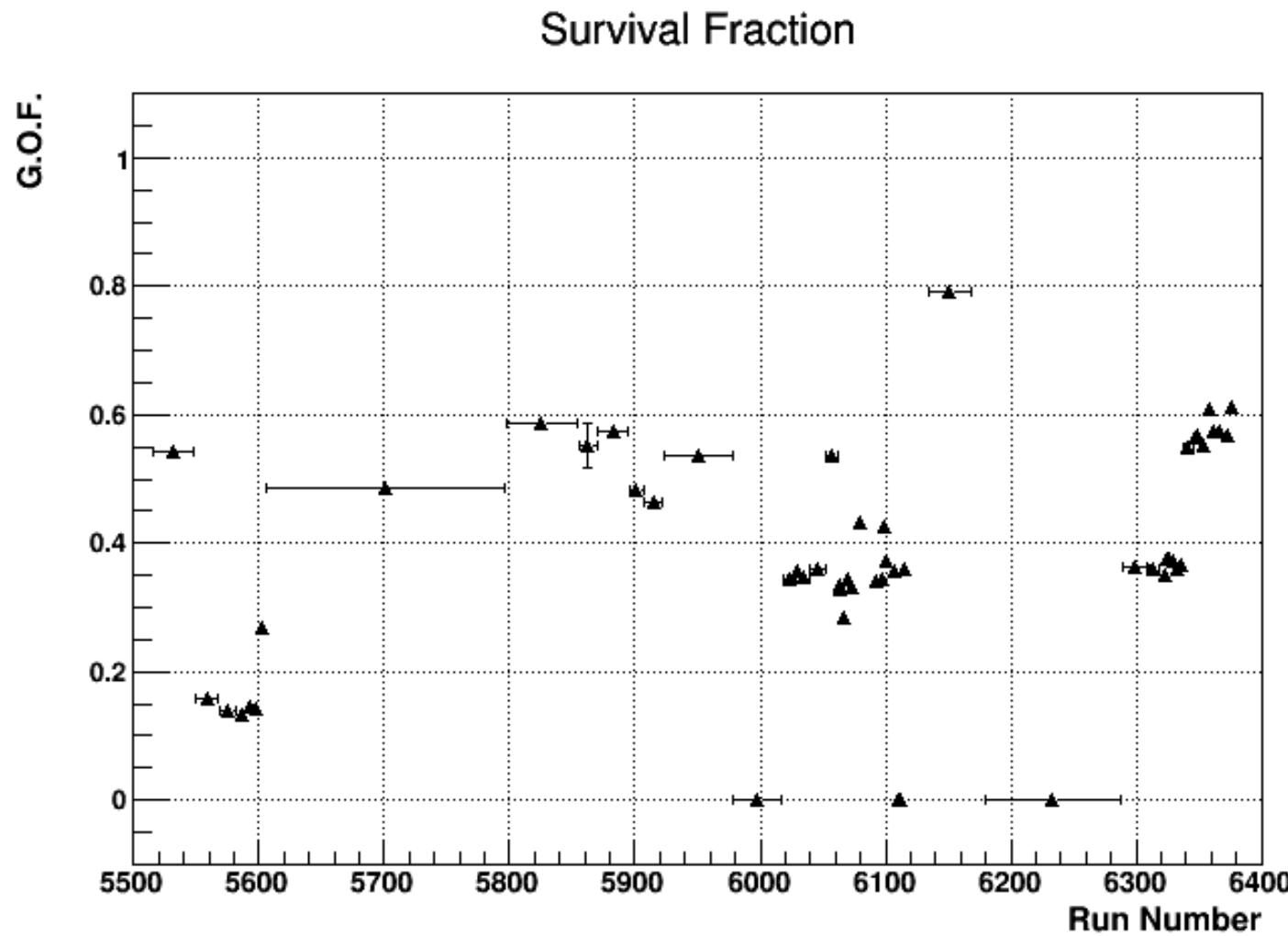
After Zenith angle cut



After Respect-to-beam angle cut



How many tracks are left after the new cuts?

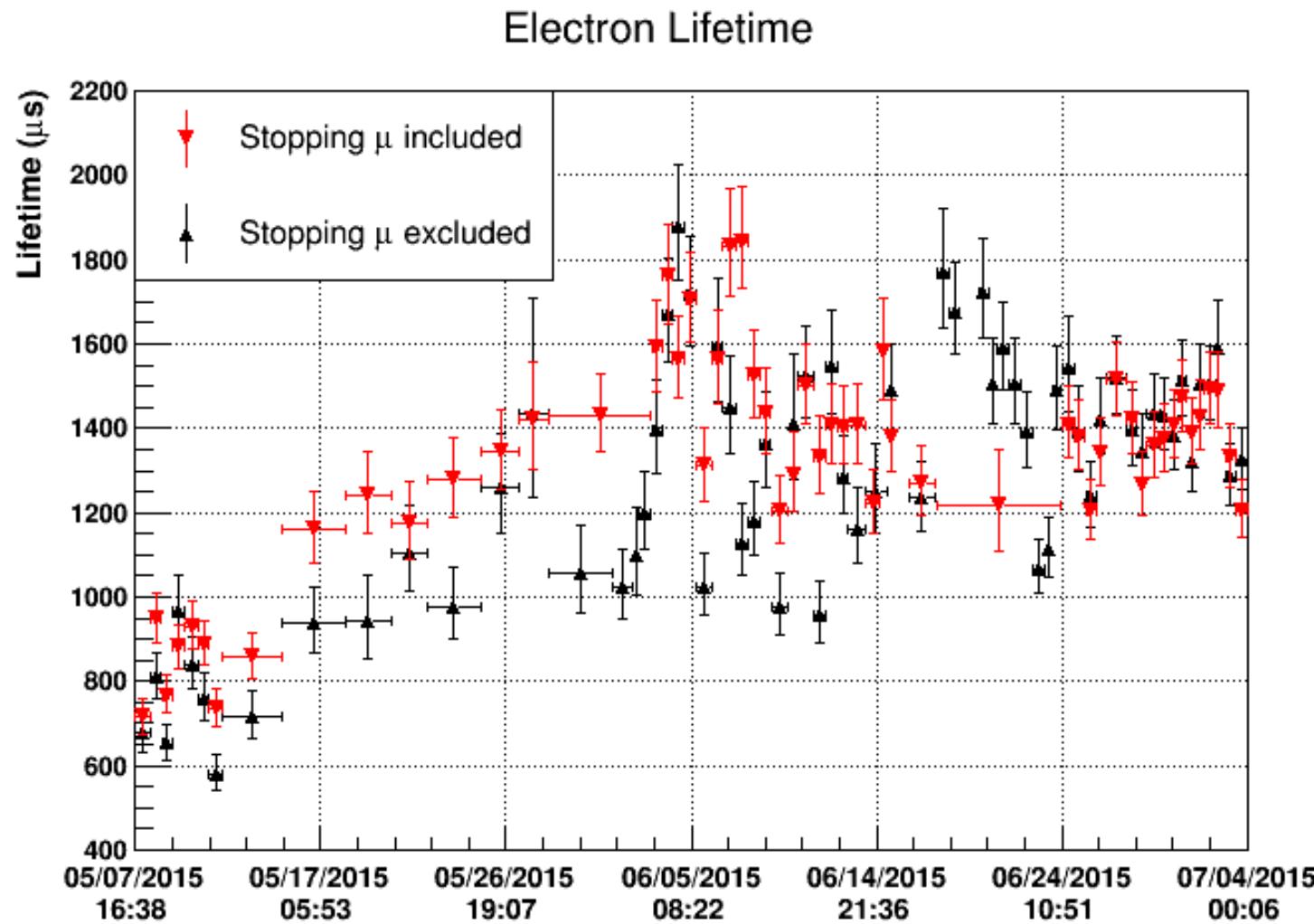


We are left in general with 40-60% of the tracks used in the first measurement

Values at 0 are not physical, it's only a change of sample size between the two measurements

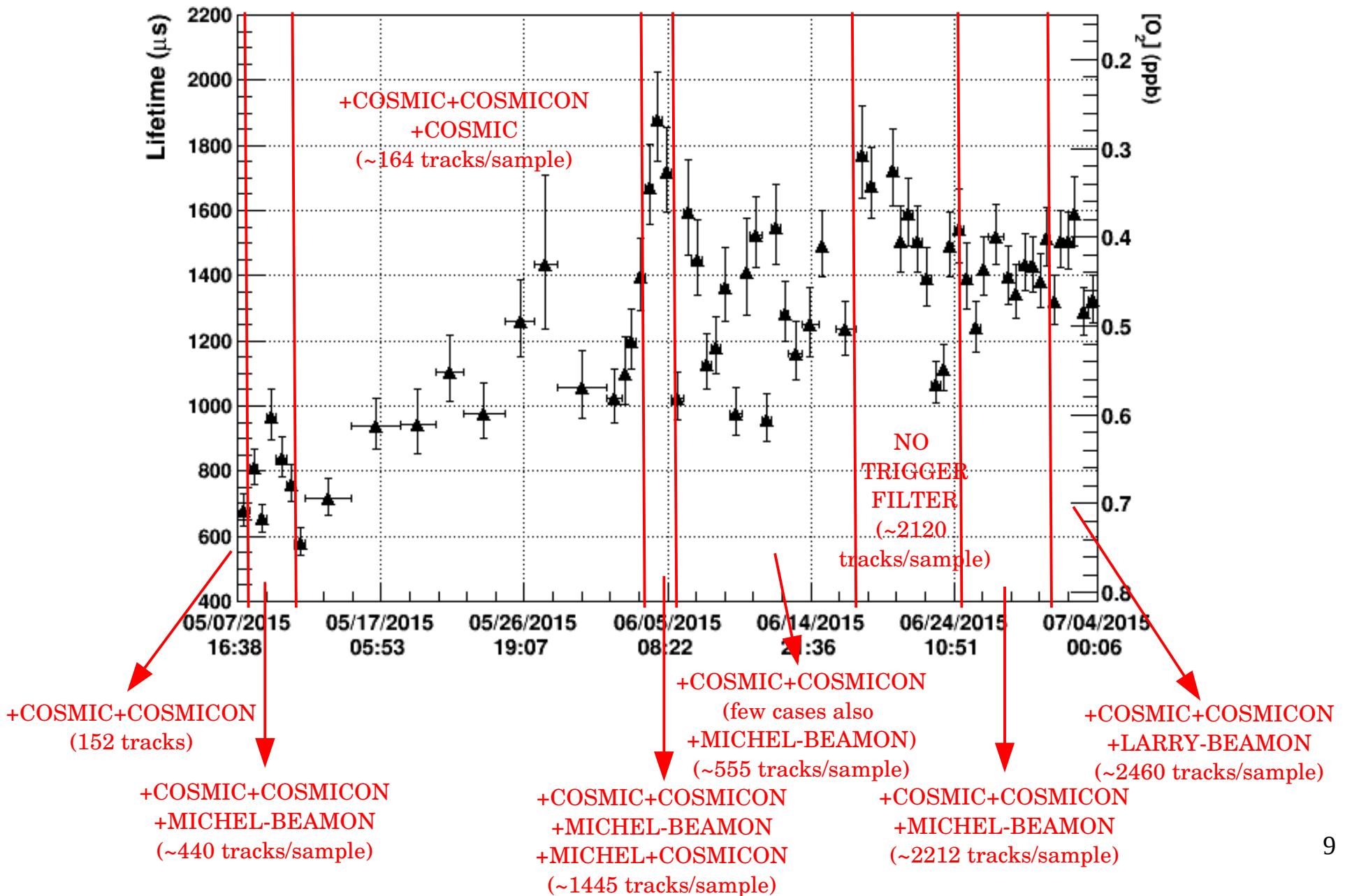
Electron Lifetime: before and after

New values more scattered, probably due to the reduced statistic. In the last part (after June 24th), where statistics is high enough (thanks to the Larry trigger), values are compatible and less scattered

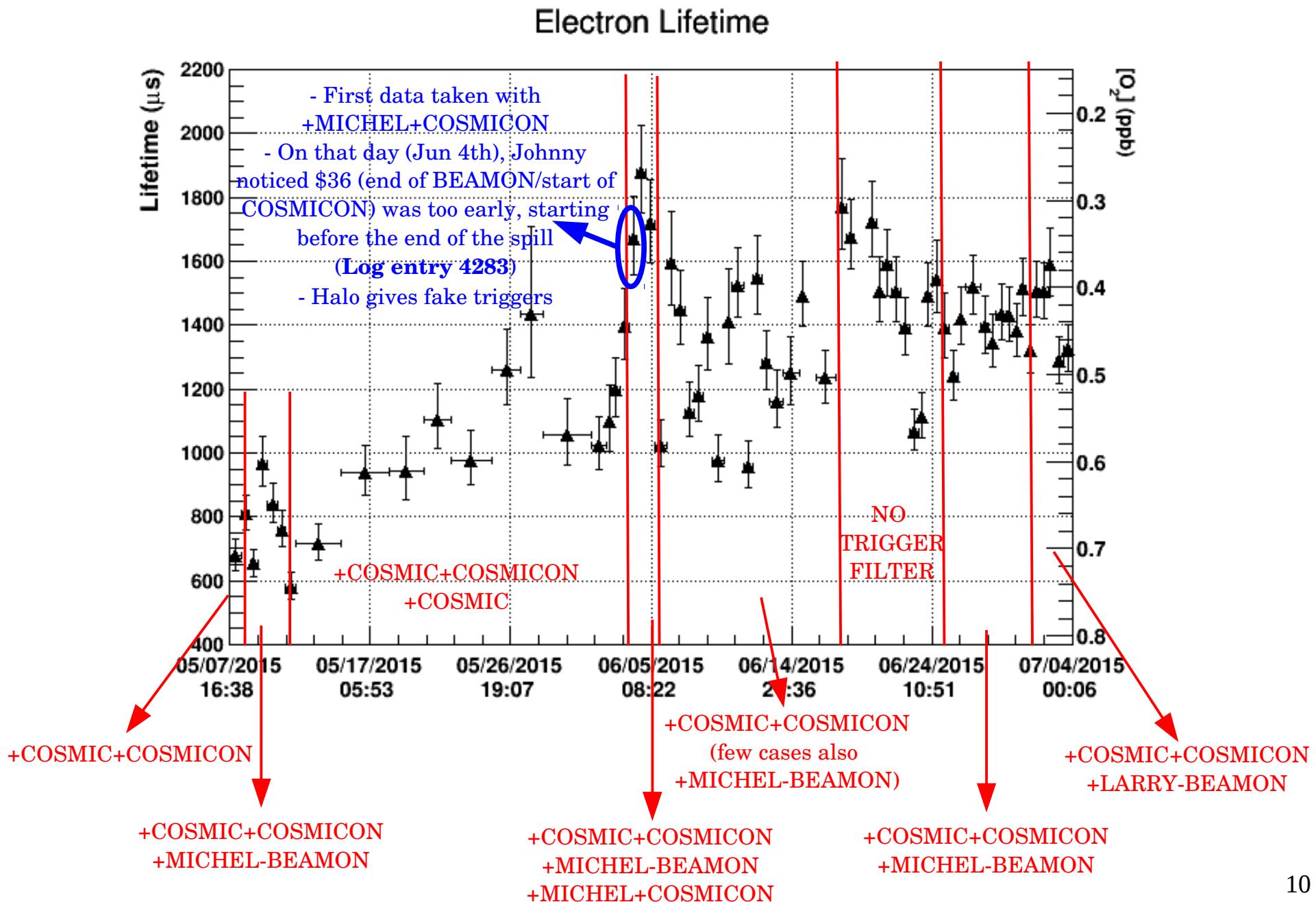


Electron Lifetime

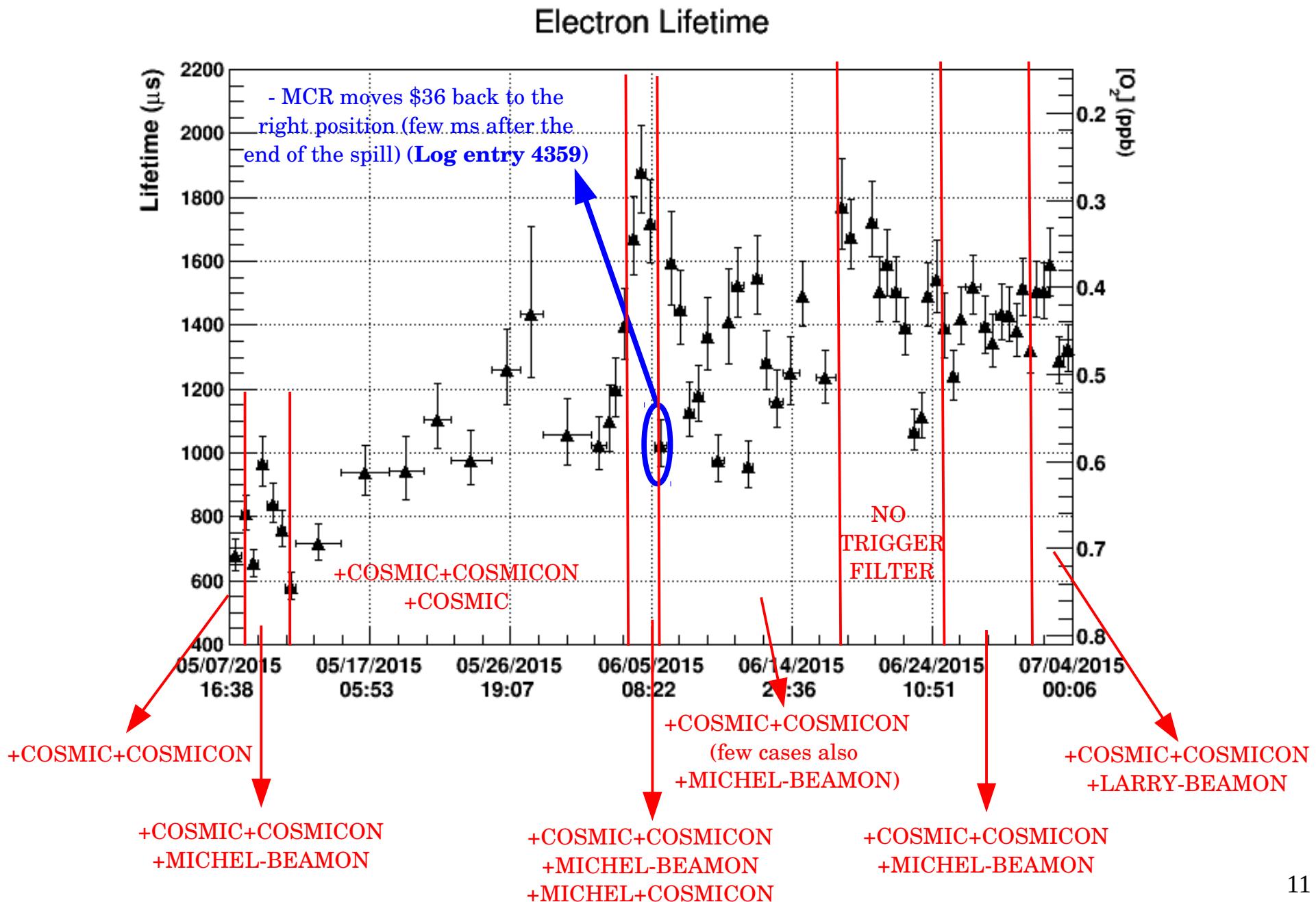
Thanks to Monica Nunes for retrieving information about trigger configuration and # of tracks for each set of runs



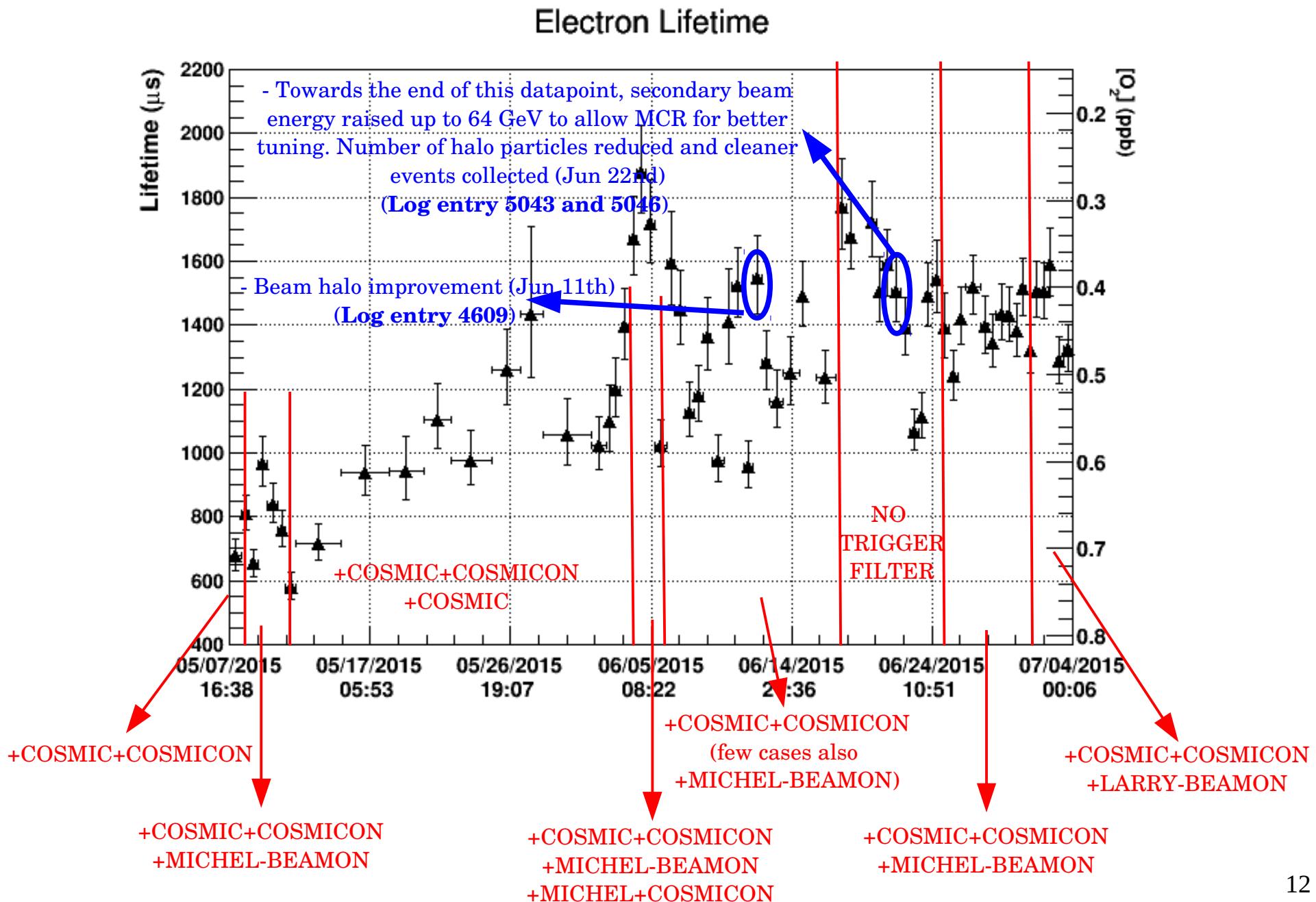
Checking data trend against the e-log



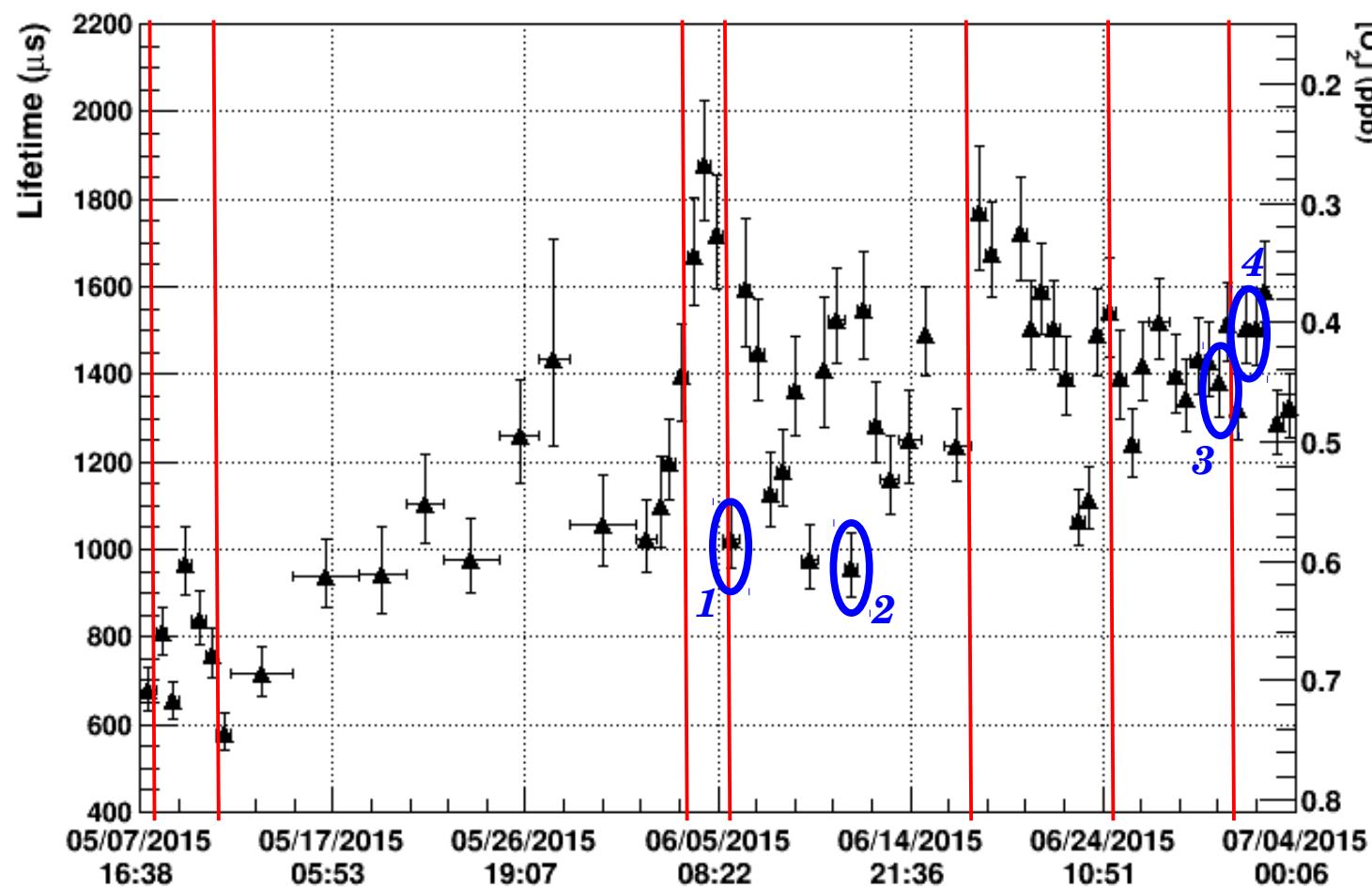
Checking data trend against the e-log



Checking data trend against the e-log

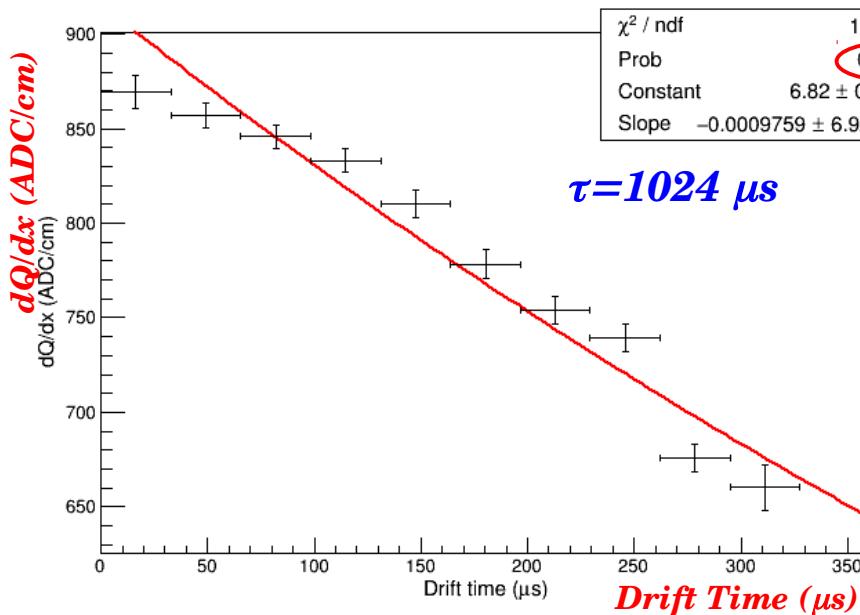


4 fit examples: 2 “bad” and 2 “good”

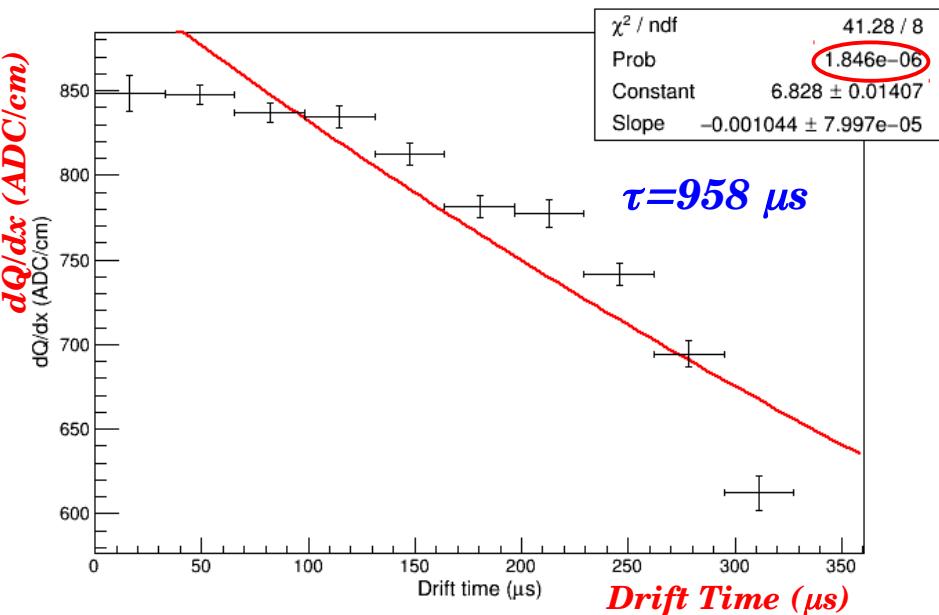


4 fit examples: 2 “bad” and 2 “good”

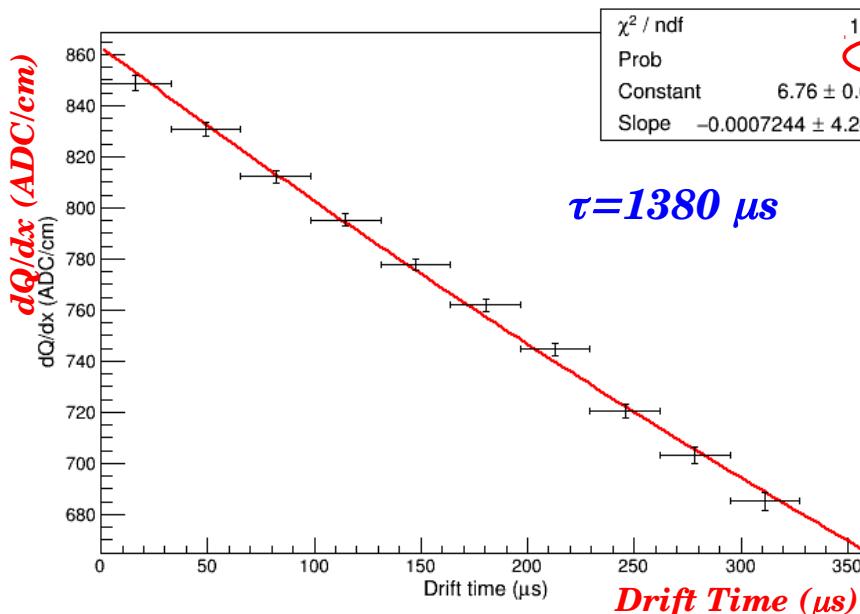
1: Run 6053-6062 / 201 tracks



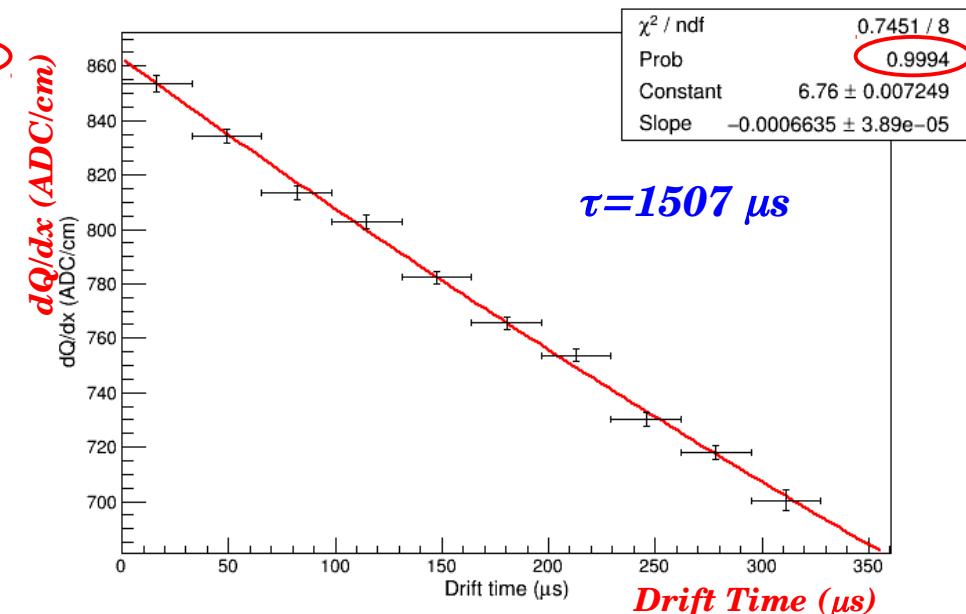
2: Run 6099 / 289 tracks



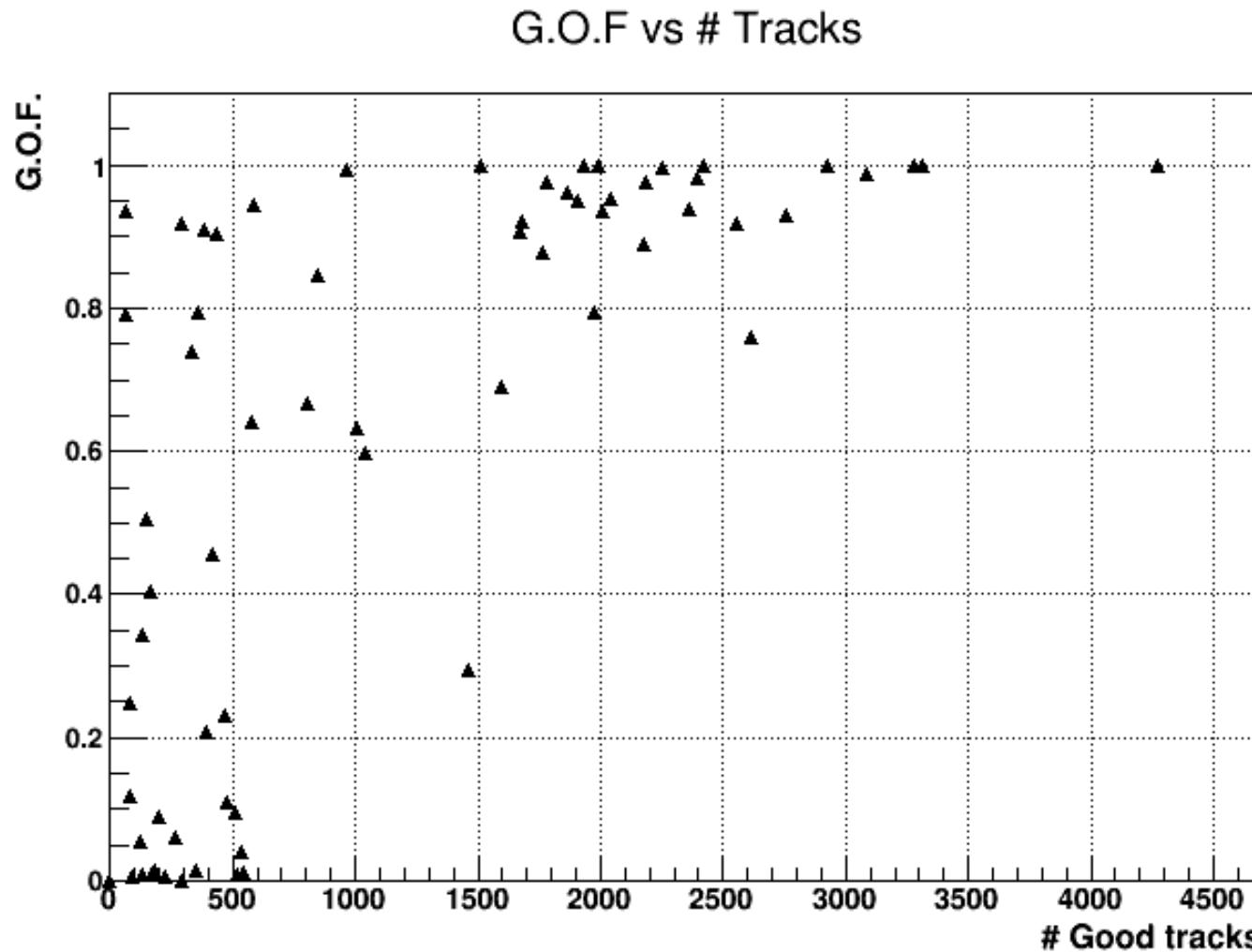
3: Run 6347 / 1937 tracks



4: Run 6357-6361 / 1995 tracks



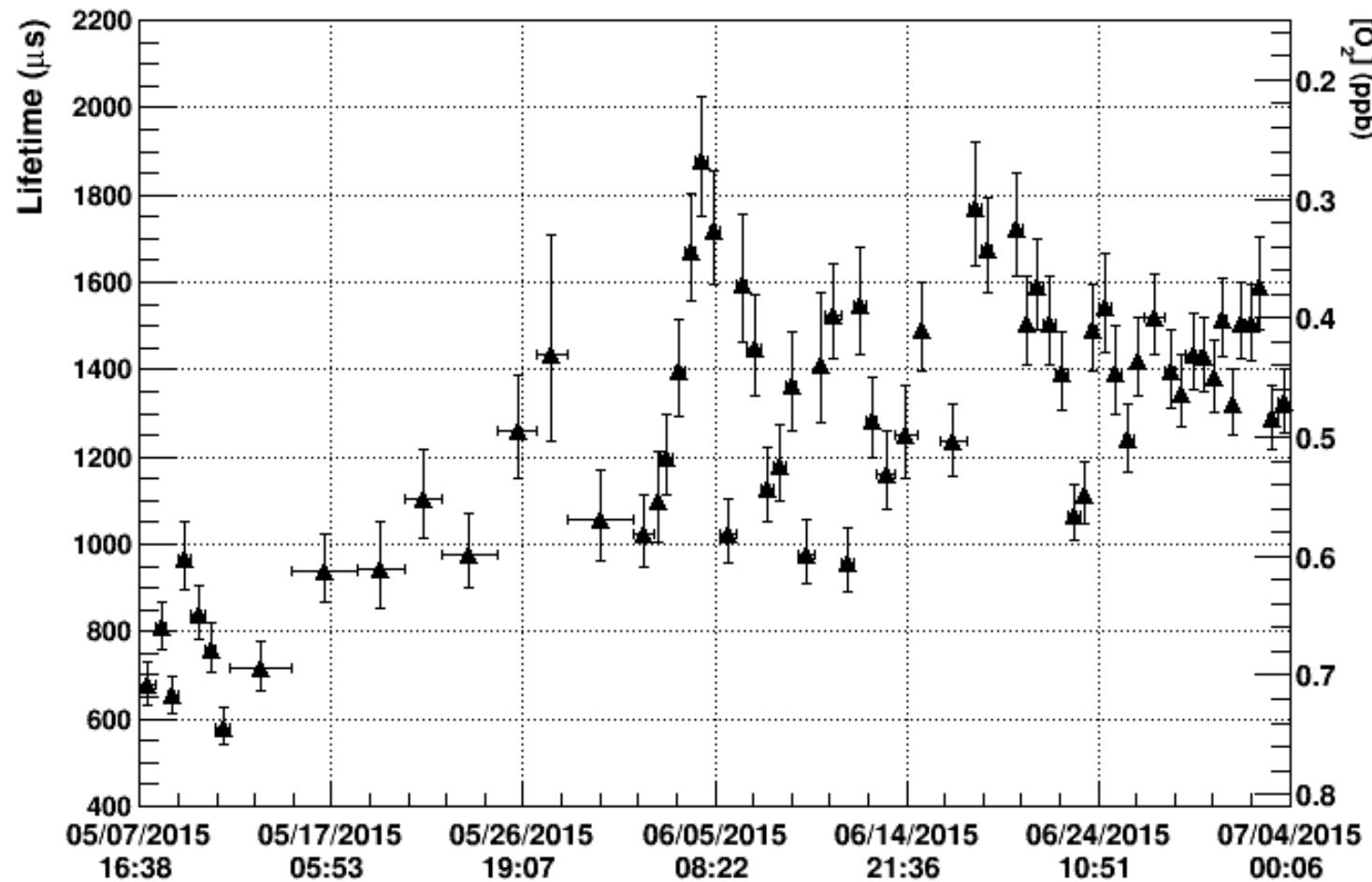
Number of tracks vs Goodness of Fit



Below 500-600 tracks statistic is low enough to have high chance of a poor fit

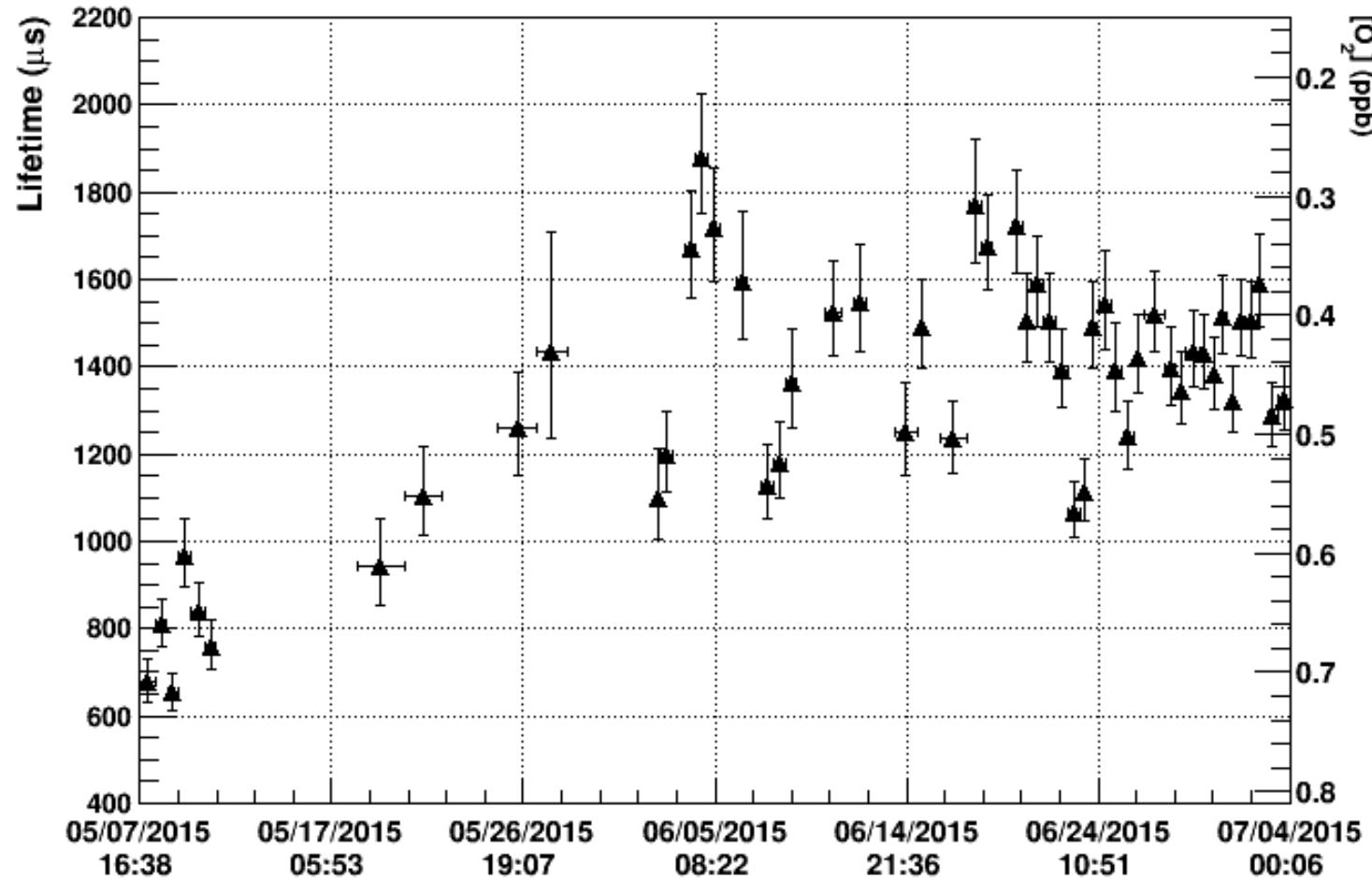
Refined Electron Lifetime

All measurements included



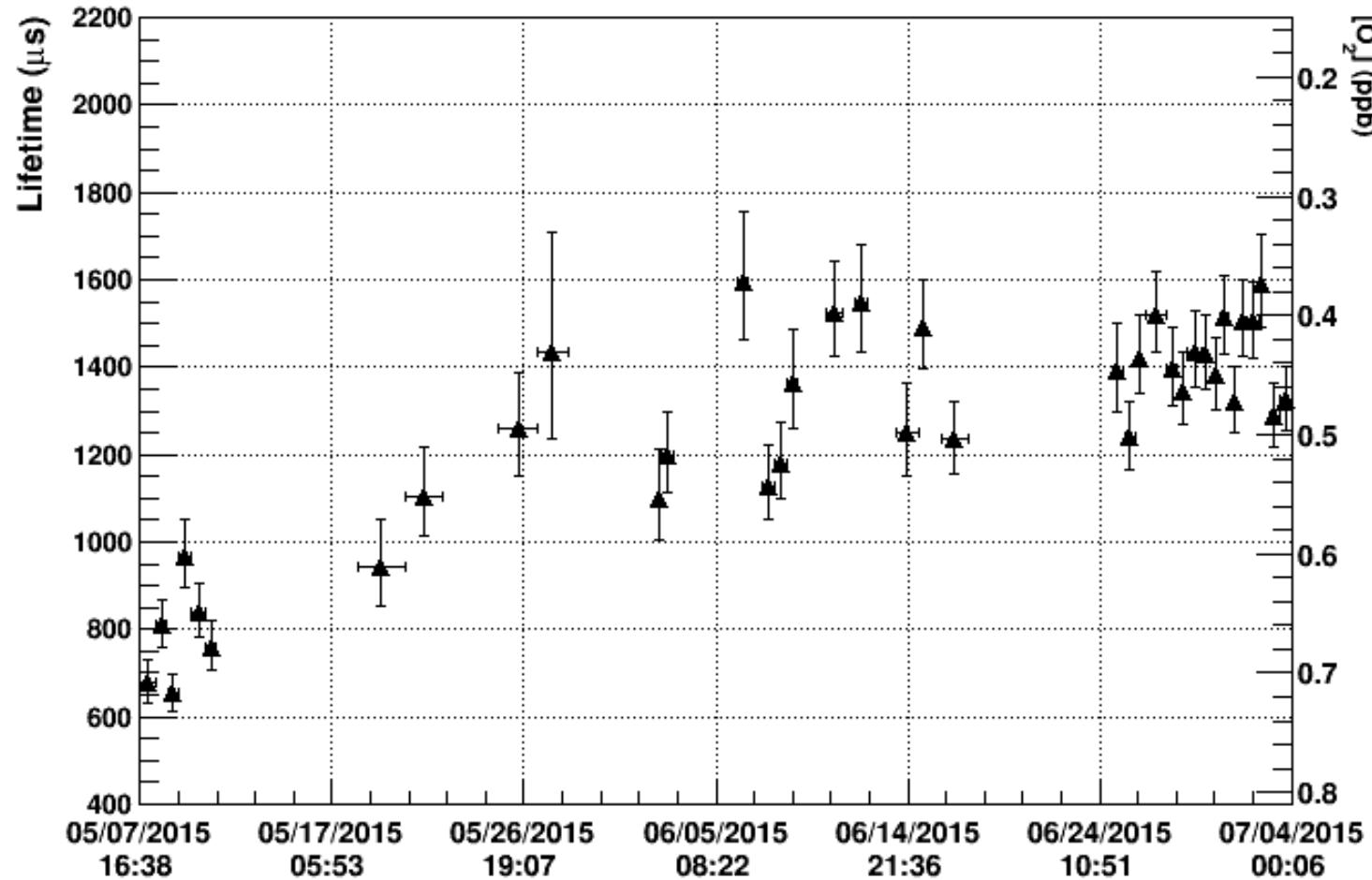
Refined Electron Lifetime

Excluded all measurements with Goodness of fit < 0.1



Refined Electron Lifetime

Excluded all measurements with Goodness of fit < 0.1 AND possible beam contamination



Is the contamination of beam particle still so high? Why do they should increase the lifetime?

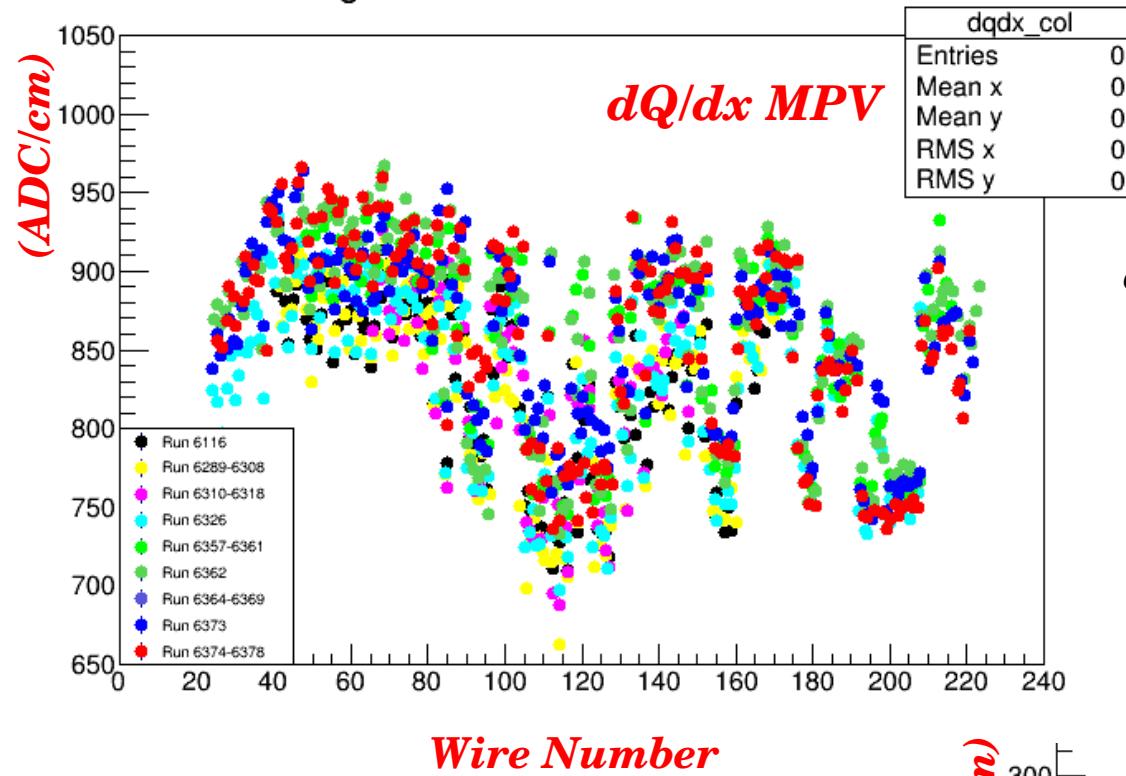
From Lifetime to Wire analysis

Using the lifetime values, I can determine the average dQ/dx deposited by a mip on each wire, to look for effects near the PMT area

- Pick a data sample with a number of good reconstructed tracks $> \sim 1500$
- For each good hit of every track, calculate the dQ/dx corrected for the lifetime and fill the histogram associated to the corresponding wire
- Fit each of the 240 histograms (one per wire) with Landau-Gaussian convolution and extract Most Probable Value and width of the ditribution (gaussian + landau sigma)
- Plot both MPV and sigma as a function of wire number
- Repeat for all the data samples with suitable statistics

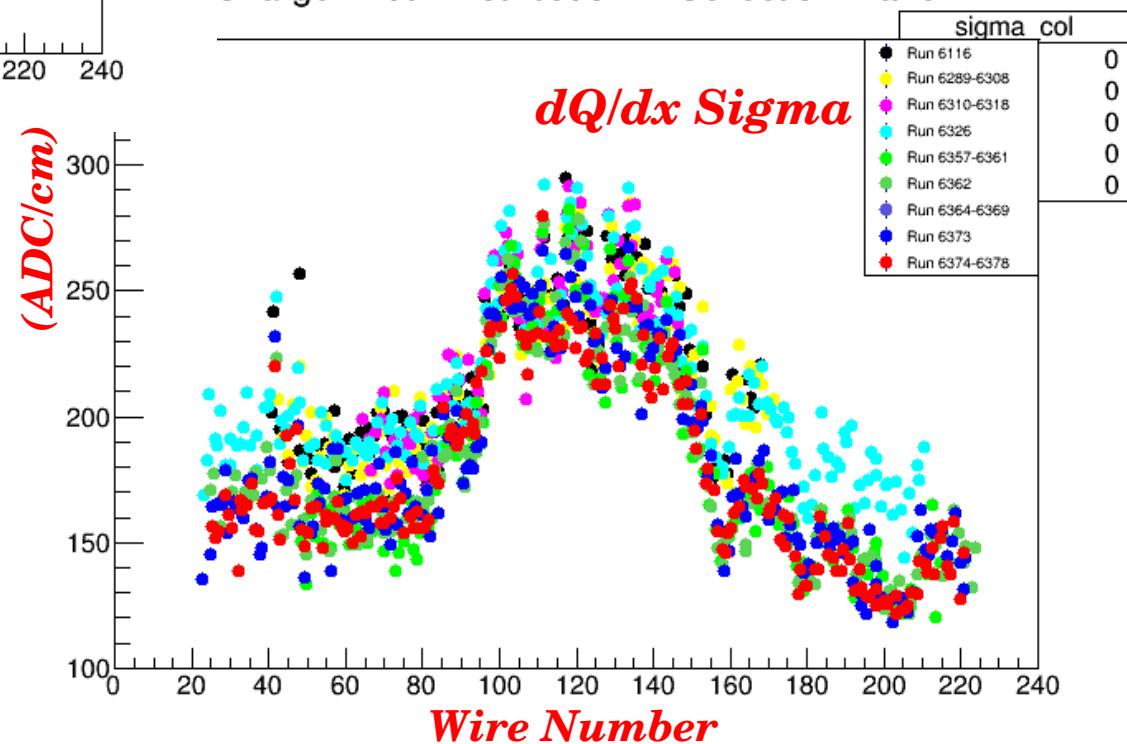
Results on 9 data samples

Charge Distribution in Collection Plane



dQ/dx drops in the area in front of PMTs and presents several spikes afterward

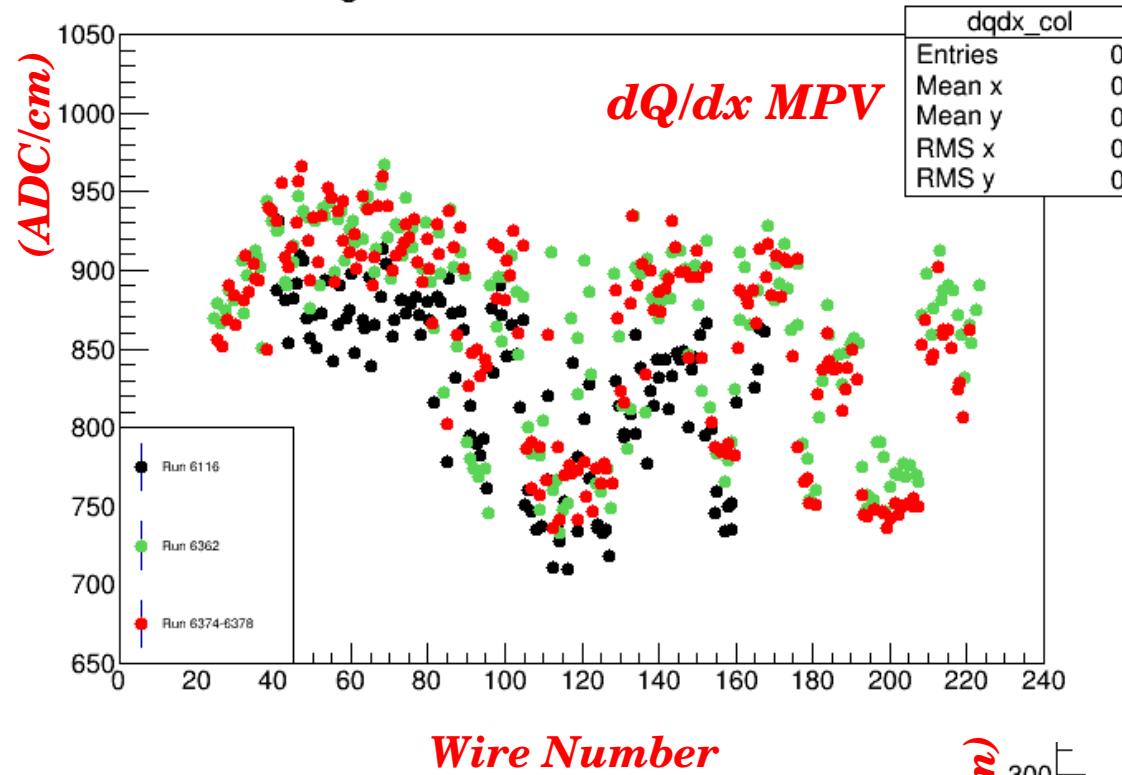
Charge Width Distribution in Collection Plane



Sigma increases in the area in front of PMTs

Results on 3 data samples

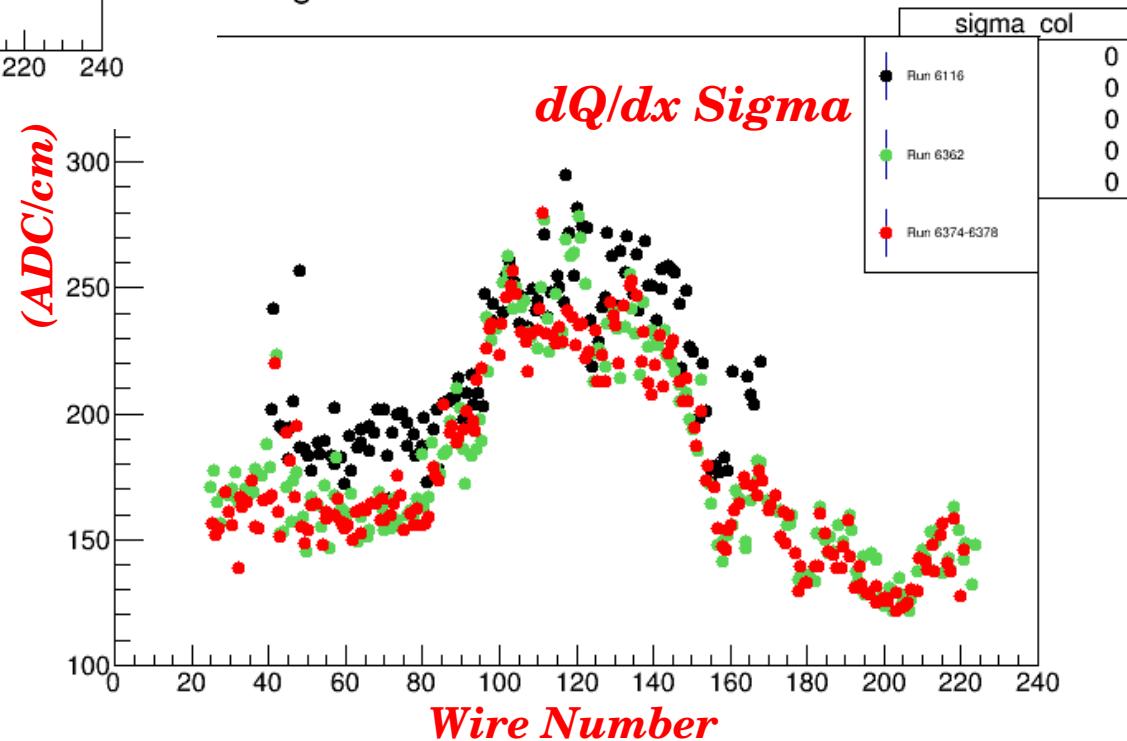
Charge Distribution in Collection Plane



Sigma increases in the area in front of PMTs

dQ/dx drops in the area in front of PMTs and presents several spikes afterward

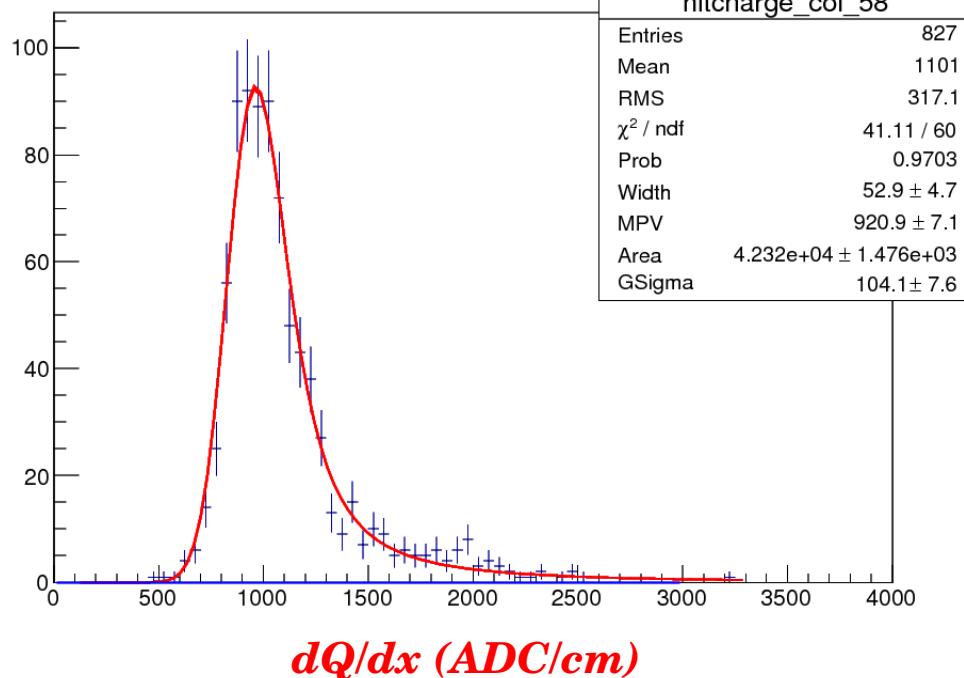
Charge Width Distribution in Collection Plane



Example of dQ/dx distribution for Run6374-6378

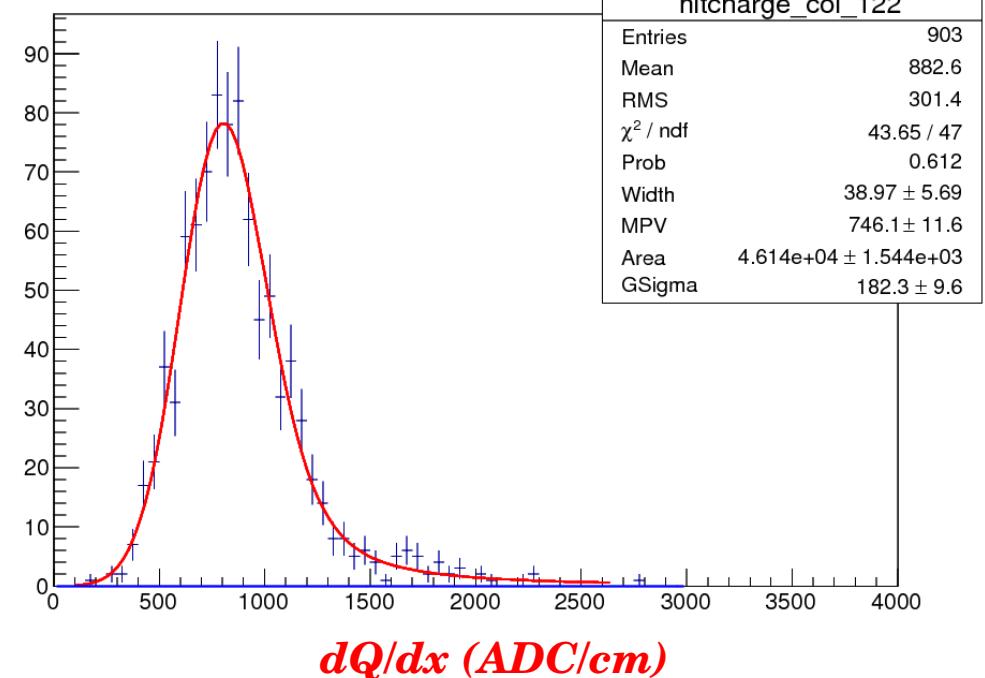
Far from the PMTs

Collection Plane - Wire 58



Near the PMTs

Collection Plane - Wire 122



Conclusions

- A reduction of dQ/dx MPV and corrispondent increase of the width of the distribution for the wires in front of the PMTs seems evident in all the observed runs
- Such an effect should be accounted for in the analysis.. but how???
- Need to re-measure the lifetime correcting for this effect (either excluding hits in front of PMTs or correcting the charge value by some amount)